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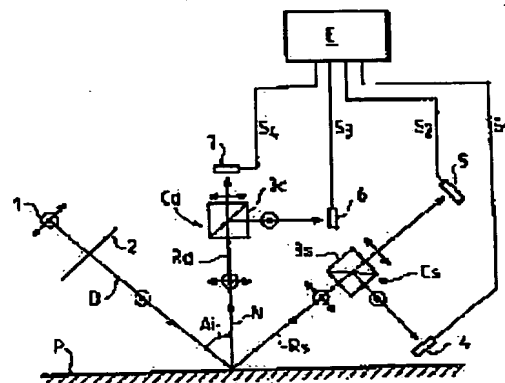
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(54) EVALUATING DEVICE FOR EVALUATING SURFACE, PARTICULARLY, BRIGHTNESS OF SKIN

(57)Abstract:

PURPOSE: To provide an evaluating device of brightness of skin in which the sensitivity and discriminating capability are improved, and the mirror-like brightness and diffusive brightness of skin can be evaluated.

CONSTITUTION: This device has a light source 1 for transmitting an incident beam to a surface P to be examined, and means having a polarizer 2 and at least one analyzer Cs, Cd. The polarizer 2 is situated between the light source 1 and the surface P, and the analyzer is situated along the route of the reflected beam. This device also has light detector means 5, 6, 7 for detecting light. The light source 1 has directivity, and the incident beam polarizing direction is orthogonal to the incident surface. The reflection is measured along at least two mutually differed reflecting directions Rs, Rd. This device has means Cs, Cd, 4, 5, 6, 7 capable of determining the parallel polarized beam and the difference between the light analyzing direction and the orthogonal polarizing direction to each reflecting direction.



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CLAIMS

[Claim(s)]

[Claim 1] The light source which can project an incident beam on a trial front face, In the parallel bearing of the direction of a polarizer, and the direction of an analyzer, or a means by which said analyzer was located in the trajectory of a reflective beam although said polarizer is located between the aforementioned light source and a front face with the polarizer and at least one analyzer which can evaluate reflection in the bearing whose right angle is pinched in said each direction, In the equipment by which brightness on a front face, especially the skin equipped with a photodetection means to detect the light reflected by the front face was evaluated On the front face which said light source (1) tends to have directivity and the incident beam which polarized tends to examine Although it does not limit, it hits on both sides of the incident angle between 0 degree thru/or 90 degrees. The incident beam polarization direction follows in at least two mutually different reflective directions Rs and Rd. One reflective direction Rs of the reflective directions, such as this, becomes the symmetry effective in the direction D of incidence to the normal to said front face. A means to produce the difference between the reflection which intersects perpendicularly in reflection parallel to the aforementioned polarization direction and the aforementioned light analysis direction, the aforementioned polarization direction, and the light analysis direction to said each reflective direction (Cd, Cs), Evaluation equipment characterized by evaluating the so-called mirror plane brightness and the so-called diffusion brightness by the difference acquired by preparing (4, 5, 6, 7), and E and doing in this way.

[Claim 2] Equipment of claim 1 characterized by having made the incident angle Ai of an incident beam into about 45 degrees to the normal, and carrying out near also of the include angle of the 1st reflective direction Rs to 45 degrees.

[Claim 3] Claim 1 characterized by locating the 2nd reflective direction (Rd) in the range of about 10 degrees at each ** of the direction N which intersects perpendicularly with a trial front face, or 2 equipment.

[Claim 4] Equipment of claim 3 characterized by making the 2nd reflective direction Rd intersect perpendicularly effective in said front face.

[Claim 5] Equipment given in either of said each claim characterized by forming the system which makes each lightwave signal which intersects perpendicularly with a light analysis means in parallel with plane of incidence again, and polarizes separate in the include-angle direction to each considered reflective directions Rs and Rd.

[Claim 6] Two photo detectors (4 5), equipment of claim 5 characterized by making (6, 7) collaborate in a separation system (Cs, Cd), and enabling it to measure each lightwave signal to coincidence.

[Claim 7] Claim 5 characterized by constituting each separation system (Cs, Cd) with a polarization separation cube (3s, 3d), or 6 equipment.

[Claim 8] Application of equipment given in either of said each claim in the case of research of the dynamics of sebum secrete.

[Claim 9] Application of the equipment according to claim 1 to 7 in the case of research of the compatibility of the base which acquires a mat-like appearance so that brightness on the skin by sebum may be reduced.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] Although this invention locates said polarizer between the aforementioned light source and a front face with the polarizer and at least one analyzer which can evaluate reflection in the bearing whose right angle is pinched in said each direction at least in the parallel direction of the light source which can project an incident beam on a trial front face, and the direction of a polarizer and the direction of an analyzer Said analyzer is related with the equipment which commented the brightness of a front face equipped with a means by which you made it located in the trajectory of a reflective beam, and an optical detection means to detect the light reflected by said front face.

[0002] This invention relates to the equipment by which brightness on the skin is evaluated to things.

[0003]

[Background of the Invention] These people have already applied for the French country patent application No. 10709 [89 to] on August 7, 1989 about this kind of equipment. Although such equipment had acquired the results whose satisfaction is possible in the carried-out trial, sensibility and the capacity according to ** were comparatively low.

[0004] The purpose of this invention has sensibility and epicritic in offering the equipment by which brightness on the front face, especially the skin which can distinguish brightness by some class with the directivity still more highly is evaluated. **** equipment is narrow — regardless of a color, it can measure over [almost] a pin point-like area.

[0005] The equipment by which it was estimated that brightness on a front face, especially the skin described above according to this invention Although the light source has directivity and a polarization beam does not limit, a trial front face is hit in an incident angle (0 degree thru/or 90 degrees). The polarization direction of an incident beam is arranged so that reflection may be measured in at least two mutually different reflective directions which mainly includes the one reflective direction symmetrical with the direction of incidence about the direction which intersects perpendicularly with plane of incidence and intersects perpendicularly with said front face. A means to define a difference with the polarization direction and the light analysis direction which intersect perpendicularly with the reflection which has the parallel polarization direction and the light analysis direction mutually to each reflective direction again is established, and it is characterized by constituting evaluation with the so-called mirror plane-like brightness and the so-called, so-called diffusion brightness according to the difference defined in this way.

[0006] As for the incident angle of the polarization beam to a front face, it is advantageous to insert about 45 degrees to a normal.

[0007] As for the 2nd direction of the considered reflection, it is advantageous for each ** of the normal on the front face of a trial to be located within the limits of about 10 degrees. As for this 2nd direction, it is advantageous to intersect perpendicularly effective in said front face. Generally this direction is located in plane of incidence.

[0008] The light analysis means is equipped with the system which can separate the polarization lightwave signal parallel to plane of incidence which intersects perpendicularly again in the include-angle direction to each reflective direction which examines. It is advantageous to make two photo detectors collaborate in each separation system, and to enable it to measure lightwave signals, such as this, to coincidence.

[0009] As for each separation system, it is advantageous that a polarization separation cube constitutes.

[0010] Such equipment is used to study the fitness of the mat base product which reduces brightness on the skin produced by brightness, especially sebum of the skin, when dynamics, the biological phenomenon, for example, the sebum secrete, which influences brightness on the skin, is studied or cosmetics are given.

[0011] It described above and also the examples of this invention also including still more nearly another item are explained to a detail about an accompanying drawing.

[0012]

[Example] drawing 1 — a front face P — the equipment by which brightness on the skin is evaluated to things is shown in diagram.

[0013] This equipment is equipped with the unpolarized light light source 1. The circle bisected with the duplex arrow head along with the diameter with the point at the core has shown unpolarized light light in this drawing. Although the circle which has a point in a core has shown the light which intersects perpendicularly with plane of incidence and polarizes, the duplex arrow head has only shown the light which polarized in parallel with plane of incidence.

[0014] The light source 1 is a source of the directive white light equipped with the optical system (not shown) which produces a collimated beam for example, along the direction D. It is made for the light which the linearly polarized light child 2 makes the midplane intersect perpendicularly in the direction D, is located between the light source 1 and a front face P, and is dropped on the skin along Direction D to have polarized.

[0015] Although the incident angle A_i pinched between the direction D of an incident beam and the direction N which intersects perpendicularly with a front face P is for 0 degree (rectangular incidence) and 90 degrees (sweep incidence), it is not limited to this. As shown in drawing, an include angle A_i is equal to 45 degrees, or its thing near this value is good.

[0016] Plane of incidence and the incident beam polarization direction after passage of a polarizer 2 cross at right angles. This equipment has measured the reflection which meets in the two mutually different reflective directions Rs and Rd. The direction Rs corresponding to specular reflection is symmetrical with Direction D about Normal N. the diffuse reflection of the light to which the light reflected along Direction RD entered in Skin P — or it is obtained by this surface reflection when surface reflection shows some irregularity.

[0017] the 2nd reflective direction Rd selected for measurement — Direction N and one — or it is good to approach in the direction N within about 10 degrees. Direction Rd is good to be located in plane of incidence.

[0018] With incident light, as for the light reflected along with 2-ways Rs and Rd, a difference does not already polarize in the shape of a straight line, either.

[0019] The light analysis means Cs and Cd are established to each trial direction, it has the separation system which makes it advantageous to consist of the polarization separation cubes 3s and 3d of the Wollaston (Wollaston) prism form, and include-angle separation of the right angle of the lightwave signal which intersected perpendicularly with this in parallel with plane of incidence again, and polarized to each reflective beams Rs and Rd is produced in this considered example.

[0020] Two photo detectors 4 and 5 and photo detectors 6 and 7 collaborate with each separation system, and can perform coincidence measurement of a lightwave signal. It is combined with the electronic means E and each photo detector can acquire necessary results by processing of a signal.

[0021] A photo detector 4 receives the reflective beam part Rs which intersects perpendicularly with plane of incidence and polarizes, and produces a signal S1.

[0022] A photo detector 5 receives the reflective beam part Rs which polarizes in parallel with plane of incidence, and produces a signal S2.

[0023] A photo detector 6 receives the reflective beam part Rd which intersects perpendicularly with plane of incidence and polarizes, and produces a signal S3.

[0024] Finally, a photo detector 7 receives the reflective beam part Rd which polarizes in parallel with plane of incidence, and produces signal S4.

[0025] A beam has Component Ic to each reflective directions Rs and Rd in the strength which produces the color of the front face substantially considered to be Component Ib in the strength by brightness of a front face. This component Ic is produced from a part of light which entered into the environment where diffraction phenomena are received before returning to a photo detector. This can be expressed as a formula 1 in practice. The formula to the beam Rs showing specular reflection is as follows.

[0026] They are $S1=(Ib+1/2Ic) s$ and $S2=(1/2 Ic) s$ [0027] to the beam Rs showing specular reflection. It can express as follows to the beam Rd which shows diffuse reflection.

[0028] $S3=(Ib+1/2Ic) d$, $S4=(1/2Ic) d$ [0029] The value whose difference between S1 and S2 is the measured value of the brightness in Direction Rs which shines, namely, is considered to be the mirror plane brightness Bs two results is given by the following formula.

[0030] $S1-S2=(Ib) s$ [0031] Result S — the difference between 3 and S4 is given by the following formula which is the brightness in the Rd direction which shines and comes out, exists and is considered to be the diffusion brightness Bd.

[0032] $S3-S4=(Ib) d$ [0033] Each results S1, S2, and S3 and S4 can be displayed on a screen with the electronic means E, and each difference is acquired manually.

[0034] According to other examples, on the other hand, the electronic means E acquires the difference between a signal S3 and S4 directly, and displays differences, such as this, namely, has expressed the mirror plane brightness Bs and the diffusion brightness Bd as a signal S1 and another side between S2.

[0035] The equipment by this invention has the remarkable capacity to identify two kinds of brightness Bs and Bd. When the irregularity of the skin is remarkable, the directivity of brightness is low and the mirror plane brightness value Bs is only higher than the diffusion brightness Bd for how many minutes.

[0036] Moreover, brightness has far high directivity, for example after processing according that a skin front face is very smooth to cosmetics, and the mirror plane brightness value Bs is remarkably higher than the diffusion brightness Bd.

[0037] The structure of the equipment by drawing 1 is shown in drawing 2.

[0038] This equipment is equipped with the base 8 held for the alignment 9 which has three impressions 10, 11, and 12 along with the axis which has Directions D, Rd, and Rs, respectively, enabling free disconnection. Impression axes, such as this, form the core of the hole 13 of the ellipse form of the lower part of an alignment 9, and reliance gathers in the front face P under trial at **** O.

[0039] It is a Point O reflection-side, and it became depressed and 10 is prolonged in ** 14 of the diameter large one layer which located the sleeve 15 in Direction D and the same axle. In the sleeve 15, the light source 1 with the electric bulb 16 furnished with the lens which produces a directional beam is established. A photo detector 17 is attached on the level of the light which comes out of an electric bulb 16 to the wall of a sleeve 15, and has measured average optical strength [the light source]. The component 17 is connected to an electronic means (not shown in drawing 2) by which the measurement result from photo detectors 4-7 was adjusted according to light source strength.

[0040] The impression 11 has extended in ** 18 in the opposite side of Point O. ** 18 is equipped with 3d of polarization separation cubes, and the photo detectors 6 and 7 which collaborate, and the unit 19 is located in it.

[0041] It became depressed in the side which counters Point O, and 12 is similarly prolonged in ** 20 of a cylindrical shape. In ** 20, the unit 21 equipped with 3s of separation cubes and photo detectors 4 and 5 is located.

[0042] If the include-angle value Ai is made into 45 degrees, the direction of the symmetry is set to Rs to a normal and the direction of a normal is set to Rd, the light source, a separation cube, and the whole photo detector can be stored in the minimum volume.

[0043] A base 8 has the hole surrounded with the color 22 in the central upper part. In the color 22, the tubular part which closed the crowning with the flat covering 24 is held by the bell and spigot. It has the electrical connector 25 for external electric connection in the core of covering 24, and the results from the photo detectors 4, 5, 6, 7, and 17 combined especially with this connector are sent. The push button 26 is attached in the wall of components 23. A push button 26 controls the light source 16 over the given time limit

which records measurement. Light is automatically extinguished with hand control with a push button 26. electric connection various within the base 8 which the assembly which forms a measuring head is held manually, and reliance obtains, and also forms a means, and a tubular part 23 has not illustrated.

[0044] The lower limit section of an alignment 9 is a truncated-cone form, and has formed the hole 13 in the pars basilaris ossis occipitalis of the smaller one of it. A crown 27 is formed so that a measuring head may be supported sufficiently certainly on a front face P, and the margo-inferior section is located effective in the flat surface of a hole 13.

[0045] The equipment shown in drawing 2 is used according to the following procedure.

[0046] the core of the area which an operator is going to hold this equipment by the cylindrical shape part of a tubular part 23, and is going to measure Point O — reliance — obtaining — ** Subsequently, push and an operator begin measurement for a push button 26 at this point.

[0047] Especially this invention equipment that can carry out space quantization of the brightness phenomenon in a mutually different direction is advantageous to especially brightness measurement of the skin in which the surface irregular section exists. This light diffuses the light reflected by the front face of the skin not only in the direction of a mirror plane which stops at a peak price but in the various direction. The equipment by this invention takes this phenomenon into consideration.

[0048] Brightness on the skin is produced from brightness and its surface condition of the proper of the skin.

[0049] Mechanical movement is not needed between a polarizer and an analyzer with the polarization separation cubes 3s and 3d, it improves and the coincidence measurement of each signal which intersected perpendicularly again and polarized in parallel with plane of incidence can do precision of this equipment.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the diagram-plot plan of this invention evaluation equipment.

[Drawing 2] It is drawing of longitudinal section of the equipment of drawing 1 .

[Description of Notations]

1 Light Source

2 Polarizer

4, 5, 6, 7 Photo detector

P Front face

Cs, Cd Light analysis means

Rs, Rd The reflective direction

D The direction of incidence

Ai Incident angle

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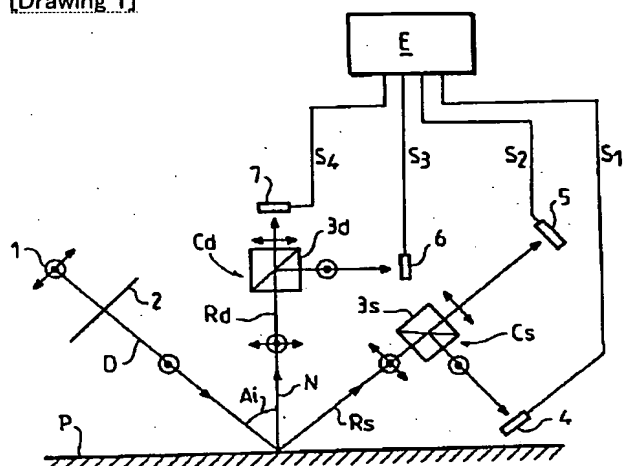
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DRAWINGS

[Drawing 1]



[Drawing 2]

